

Fuzzy modeling of brain tissues in Bayesian segmentation of brain MR images

ABSTRACT

Segmentation of brain MRI is the core part in plenty of medical image processing methods. Due to some properties of MR images such as intensity inhomogeneity of tissues, partial volume effect, noise and some other imaging artifacts, segmentation of brain MRI based on voxel gray values is prone to error. Hence involving problem specific information and expert knowledge in designing segmentation algorithms seems to be useful. A two-fold fuzzy segmentation algorithm based on Bayesian method is proposed in this paper. The Bayesian part uses the gray value of voxels in segmenting images and the segmented image is used as the input to fuzzy classifier to improve the misclassified voxels especially in borders between tissues. Similarity index is used to compare our algorithm with the well known method of Ashburner which has been implemented by Statistical Parametric Mapping (SPM) software. Two different brain MRI datasets are used to evaluate the algorithm. Brainweb as a simulated brain MRI dataset and ADNI as real brain MRI dataset are practiced images. Results show that our algorithm performs well in comparison with the one implemented in SPM. It can be concluded that incorporating expert knowledge and problem specific information in segmentation process improve segmentation result. The major advantage of proposed method is that one can update the knowledge base and incorporate new information into segmentation process by adding new fuzzy rules.

Keyword: Magnetic resonance imaging (MRI); Segmentation; Bayesian classifier; Fuzzy method